Atatürk Üniv. Diş Hek.Fak.Derg
Cilt: 15, Sayı:1, Sayfa:22-28, 2005

THE INVESTIGATION OF THE MARGINAL MICROLEAKAGE OF FOUR TEMPORARY CEMENTS IN METAL CASTINGS

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ÖZET

Bu çalışmada, metal döküm kuronlarda geçici simanların marginal mikrosızıntısı incelenmiştir. Bu amaçla, çekilmiş premolar dişler üzerinde 20 metal döküm kuron hazırlandı. Üretici firmanın önerileri doğrultusunda hazırlanan 4 siman (Scutabond nF, Tempbond, Sinogol, Provilat) kullanılarak simantasyon işlemi yapıldı. Örneklere termal siklus uygulandıktan sonra, sızıntının tespit edilebilmesi amacıyla metilen mavisinde bekletildi. Örneklerden kesit alınarak stereomikroskop altında incelendi. Diş-siman arayüzündeki boya penetrasyonu için 5 seviyeli skala kullanıldı. Mikrosızıntı değerleri bir kişi tarafından kaydedildi. Biometrik değerlendirme için Kruskal-Wallis analizi kullanıldı (P<0.05). Öjenollü geçici simanların öjenolsüzlerden daha fazla mikrosızıntı oluşturduğu, Scutabond nF' nin diğer simanlardan daha yüksek mikrosızıntı değeri gösterdiği, öjenolsüz Provilat' ın en iyi sealig ve en az mikrosızıntı değeri gösterdiği tespit edildi.

Anahtar Kelimeler : Geçici siman, mikrosızıntı

SUMMARY

This study was carried out to evaluate the marginal microleakage of four temporary cements in metal crowns. Twenty metal crowns were prepared and fitted on extracted intact human premolars using four cements (Scutabond nF, Tempbond, Sinogol, Provilat). Each cement was mixed according to the instructions of the manufacturers. Specimens were thermocycled and submerged in a methylene blue solution and then sectioned and observed under a light stereomicroscope. A 5-level scale was used to score dye penetration into the tooth-cement interface. Microleakage values were recorded by only one person. Kruskal-Wallis Variance analysis was used for biometric evaluation of microleakage (P<0.05).

The temporary cements with eugenol showed more microleakage than those without eugenol. Microleakage was higher in Scutabond nF than the other cements. Cements without eugenol (Provilat) had the best of sealing properties and the least value of the microleakage.

Key Words: Temporary cement, microleakage.

INTRODUCTION

Temporary cementation of permanent and temporary restorations includes a number of clinical applications, such as providing aesthetic appearance, mouth hygiene, better articulation in the patient's mouth, abutment teeth control, periodontal treatment and occlusal adjustments, displacement of teeth, caries and pulp protection.[1-5]

Temporary cements consist of two basic types: the first one contains zinc-oxide eugenol and the other is without zinc-oxide eugenol.[6] The pH of the first type of eugenol cements is 7 and this type of cement shows extreme acceptance by

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the pulp. In addition to closing the cavity extremely well against saliva, it reduces the irritation resulting from microleakage to a minimum level even though in a short time. Although this cement is not physically or mechanically good, it has excellent biological features.[7] Temporary cements with eugenol show good bacteriostatic effect.[7,8] It is very easy to remove the zinc oxide-eugenol cement from the tooth; they are cheap and have protective effect against dentinal hypersensitivity.[9,10] However, they show negative effects on polymerization if composite resins are used as temporary restoration.[11-14] The non-eugenol cements were no effected the surface hardness of composite resin and showed higher microhardness than the eugenol containing cements.[12]

The conduction of mouth liquids to the pulp through dentin channels wouldn't have been possible and postoperative dentinal pain couldn't have developed on the tooth[15] if microchannels and micropores hadn't occurred between restorations and the teeth. Yet there occurs microleakage between restorative materials and tooth tissue as an inevitable phenomenon.[16] It has been stated that marginal gap is effective on microleakage and solubility of cements.[17-21]

It has been reported that microleakage might be caused on the crown margin by thermocycle.[22] It has also been stated in some other researches that heat differences in the mouth and effects of food taken into the mouth play an important role in the occurrence of leakage.[23-26]

Several in vivo and in vitro investigations have been made on microleakage between the tooth and restoration so far.[27,28] Different test methods applied in the studies for the determination of microleakage yielded to various results.[16,25] Among the methods used in the leakage studies, radioisotope method has been preferred especially for the crown studies. However, especially because of being expensive and having some disadvantages, this method has not been applied.[29-32]

In vitro microleakage tests carried out with dyes are considered stricter than those carried out in the oral cavity.[17] This is probably due to many reasons, such as:

1. The dye is more easily diffused than bacteria and their byproducts,

2- The build-up of proteins and debris that then calcify in the marginal gap may improve the seal, or

3-The dentinal fluid in vital teeth, which has a positive pressure, and the settling of fibrinogen inside the sectioned tubules may contrast molecular penetration.[33]

The purpose of this study was to compare in vitro the marginal leakage of four temporary cements.

MATERIALS AND METHOD

20 premolar teeth without caries extracted for periodontal or orthodontic reasons were kept in distilled water at 37°C until prepared for the study. Then the teeth were dried. The roots were embedded in acrylic resin with 20-mm-diameter

cylindrical mould obtained from the polyethylene. The teeth were prepared with the help of diamond bur for full crown restoration. The teeth were numbered. The dies were covered with three-fold die-spacer (Ivoclar, Schaan, Lienchtenstein. Copings were prepared on the dies by using inlay casting-wax (Ash Pinnacle, Amalgamated Dental).

The casting process was performed in a semi-automatic centrifuge casting device (Bego, Fornex 35 M). The casting was removed from the investment. Investment debris and oxicide layer on casting surface were removed by sandblasting (Minipol, Bego). The teeth were divided into four groups. The restorations were cemented according to instructions of the manufacturers at 23± 1 °C (Table 1). They were placed on the device specially prepared and a vertical 10-kg pressure was applied to it. Then the excess cement was removed from the teeth surface.

Table 1.Temporary cementation substances used in the study.

Product	Manufacturer
Scutabond nF (Zinc oxide eugenol)	EspeDental-Medizin GmbH & Co.KGD-82229 Seefeld, Germany
Tempbond (Zinc oxide eugenol)	Kerr USA 28200 Wick Road Romulus MI 48174-2600
Sinogol (Without eugenol)	P.O.B.D-2190 Altenwalde, Germany
Provilat (Without eugenol)	P.O.B 2305 D-2350 Neumünster Germany

After the specimens had been kept in distilled water at 37ºC ± 1°C for two weeks, they were subjected to thermal cycles 250 times with a 23-second program at 5°C and 50°C.[32] In this way, a similarity was formed with the heat changes within the mouth.

The specimens were stored in distilled water at 23°C ± 1°C room temperature for 24 hours after thermal cycles. Then the specimens were dried, and nail-polish was applied three times on the sections where a methylen leakage from the margins of crown was not desirable.

The specimens were kept in petri boxes in 2% methylene blue for 24 hours following the drying of the polish. Then the specimens were removed from dye solution, washed and dried. They were embedded in autopolymerizan transparent acrylic one by one. Test specimens were divided into two parts in vestibulo-lingual direction throughout vertical axis. Microleakage values were recorded by only one person according to the scale accepted by Tjan et al: [34,35]

0 : No microleakage

1 : Microleakage to one third of axial wall

2 : Microleakage to two thirds of axial wall

3 : Microleakage along full length of axial wall

4. Microleakage over occlusal surface

As for biometric evaluation, Kruskal-Wallis Variance analysis method was used.

RESULTS

The degree of dye penetration for the four temporary cements was tested and Kruskal-

Wallis Variance analysis results are shown in Table 2.

As seen in the Table, microleakage values of Scutabond nF and Provilat are different. The difference between these two temporary cements is statistically significant (P<0.05).

Although all temporary cements showed microleakage of various degrees at the end of the test duration, it was observed that Provilat showed the least microleakage while Scutabond nF showed the largest microleakage.

Table 2. Degree of Dypenetration of four cement materials and the results of Kruskal-Wallis variance analysis.

Cements	N	Marginal microleakage score frequencies 0	1	2	3	4	Median
Tempbond	5	-	-	2	3	-	2.000
Provilat	5	1	2	2	-	-	1.000
Scutabond Nf	5	-	-	2	2	1	3.000
Sinogol	5	-	3	2	-	-	1.500

H=7.84, d.f =3, P< 0.05.

DISCUSSION

Microleakage and marginal gaps are the important causes of fixed restoration failures.[36-38] The amount of cement exposed to oral fluids, which depends on the marginal gap, may be related to cement dissolution. Cement dissolution can promote microleakage, but other causes such as mechanical properties of luting cement and adhesion between cement and tooth structure are involved.[18,39]

In this study, specimens were kept in the wet medium to imitate the events occurring in the mouth environment and then they were subjected to thermal cycle with a pre-determined program.

Tjan et al[26] stated that thermal cycle in the formation of microleakage became effective on the margins of metal crown. Crim[23] stated that food and beverage taken into mouth would be comfortable in 50° C temperature and he also pointed out that the number of cycles which would be applied to the specimens and the temperature which would be used during thermocycle were important.

Michailesco et al.[40] emphasized that the temperatures used during thermocycle experiment should be in physiological limitations (17°C-47°C).

Tanaka et al.[22] observed that a certain tiredness was formed in the specimens at 70°C in their study, in which they applied 20.000 cycles to the specimens at three different water baths of 50°C, 60°C and 70°C. And they stated that temperature is more important than the number of cycles in thermocycle process.

In the previous studies of teeth restored with composites, no significant difference in dye penetration was found between 100 and 1500 cycles,[23] and between 250 and 1000 cycles.[41]

Crim and Gorcia-Goday[24] determined that composite restorations bonded with resin in class V preparations, and thermocycle application and keeping time had no significant effects on microleakage.

It was determined in a study carried out by Crim et al.[23] that there was no certain difference between four different thermocycle processes, and that the use of stain and an isotope became effective and penetrative to the same degree on the interface of tooth restoration. In their studies, all the processes including thermal change showed more leakage than noncycled methods.

Lewinstein et al.[37] investigated the fact that Tempbond showed significantly higher dye penetration than other cements. The marginal leakage values of crowns cemented with temporary cements were similar.

In this study, Provilat showed the least microleakage while Scutabond nF showed the largest microleakage.

The microleakage observed in all the temporary cements tested in this study happened to be between biologic tissue and cement. Although the weakness of this interface is required to allow easy removal of the restoration from the teeth, this may have an adverse effect on the marginal seal, thus increasing microleakage. Cement dissolution is a slow process, and probably could take place only later, enhanced by cement micro-fractures.[18]

White et al.[18] investigated the relationship between leakage and marginal gap. They couldn't find a significant relationship between leakage and marginal gap. They pointed out that complex interaction between dental restorations, cementation agent and tooth structure affect leakage.

Ballard et al.[25] stated that there was a strong relationship between leakage and thermal expansion coefficient and they maintained that, depending on their findings, microleakage in dental materials having low-thermal expansion would be lower.

Tjan et al.[19] examined whether keeping in water bath became effective on marginal microleakage in cast crowns. They couldn't find a significant difference between the durations of keeping.

Mash et al.[20] prepared gold-cast crowns on newly extracted molar teeth and cemented with Tempbond as temporary cementation material. After the castings were cemented by keeping the castings in radioactive substance, it was their ntention to determine the scores of the leakage 1, 6 and 12 months later. They determined that the leakage increased in Tempbond cement depending on the time.

The weak mechanical properties of temporary cements are likely to worsen in time[27].

According to the results of the study carried out by Olin et al.[7] and Duymus Yesil,[42] bond strengths of temporary cements without eugenol were higher than those with eugenol. Similarly, it was found out in this study that temporary cements without eugenol (Provilat) showed the least microleakage and the ones with eugenol (Scutabond nF) showed the greatest microleakage.

CONCLUSIONS

All materials tested demonstrated different degrees of microleakage. Without eugenol cements had the best sealing properties (Provilat). These cements showed the least microleakage. The temporary cements with eugenol (Scutabond nF and Tempbond) showed more microleakage than those without eugenol (Provilat, and Sinogol).

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